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ABSTRACT

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An Approach to the Semantics of Verbs

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A B S T R A C T

The paper explains a method of semantic analysis developed in the course of a natural-language research project (*) that led to the computer implementation of the Multistore Parser (1).

Positing an interlinguistic substratum of semantic particles (components) of several different types (e.g. substantive, attributive, developmental, relational), a method is illustrated which makes it possible to map the meaning of activity words in context; the resulting mappings, on the one hand, incorporate much of what, hitherto, has been considered 'pragmatics', and on the other, they furnish an exact definition of the semantic 'deep structure' underlying the grammatical surface structure of a phrase or sentence. The mappings are here used to demonstrate semantic similarities and discrepancies between an English verb and the German verbs which are required for its translation in various contexts.

(*) This research project was carried out at the Georgia Institute for Research, sponsored in part by the U.S. Air Force Office of Scientific Research, Information Sciences Directorate.

An Approach to the Semantics of Verbs

Ernst von Glasersfeld

Any discussion of semantics necessarily involves the somewhat controversial item that, in every-day language, is called 'meaning'. When philosophers hear that term, they usually get nervous and irritable because they immediately suspect that at least some of their basic epistemological beliefs are about to be attacked in an unprofessional or downright barbarous fashion. Let me at once put them at their ease: what I intend to discuss here need not cause them any concern - it is nothing but a very simple empirical tool for naive language mechanics such as lexicographers, translators, and the like, for people, in other words, who are trying to cope with language as a manifest means of communication rather than a phenomenon requiring ontological or epistemological investigation.

Let me try to make this quite clear. When a lexicographer, under the heading chair, puts down "A single seat with a back and usually four legs", (2) he is not in the least interested whether the item he is trying to define is an object of the 'real world', a god-given 'idea', a 'stimulus' for more or less observable responses, or a 'concept'; but he is interested in helping others to use the word "chair" in conformity with the generally accepted usage of linguistic communication, so that they will be able both to formulate and to interpret linguistic expressions that contain that word.

Similarly, a translator, who has to render the English sentence "John hit the ball" into German, does not in the least care whether the proposition contained in the sentence is true or false, but only with what the sentence means; whether it 'refers' to so-called facts of the real world or to the figments of a lunatic's imagination is irrelevant to the translator - all he has to watch is that the statement, as statement, remains as much as possible the same when he formulates it in the second language.

But how, one might well ask, is a translator (or anyone else, for that matter) to know when and when not there is an acceptable correspondence between the meaning of the English sentence and that of a German one presented as its translation? - So far, indeed, all we have to go on is the judgement of people who happen to be competent in both languages.

Where single words are concerned, we seem to be a little better off than with sentences, for we do have bilingual dictionaries, i.e. compendia in which the bilingual competence not only of single individuals, but of many, and sometimes even of several generations, has been more or less aptly recorded. Thus, faced with the English word "chair", we stand a good chance of finding, in an English-German dictionary a German word for which the definition 'single seat with back and usually four legs' is equally valid. And this is so for various types of word such as nouns and adjectives and adverbs. - It is true that, since many words are ambiguous in either or both the languages, there often is no simple one-to-one correspondence. But these ambiguities, which arise from the fact that a word is susceptible to more than one definition, have been fairly exhaustively treated by the lexicographers, and once we have decided which of the definitions is the intended one, we rarely have trouble in finding the foreign-language word that fits it.

In the case of verbs, however, the situation turns out to be far more treacherous. Take the verb "to hit", so frequently chosen as example in linguistic papers, presumably because of its apparent simplicity. On the face of it, the sentence "John hit the ball" does not seem at all ambiguous; yet, if we want to translate it - even into as closely related a language as German - we immediately run into difficulties. It could be "schlagen" or "treffen", "schlagen" plus the preposition "auf" or "an" or "gegen", or "stossen" plus one of the same prepositions; and the trouble is that, in German, hardly any of these expressions are at all interchangeable.

The reason for these discrepancies is not difficult to find: it springs from the fact that the German verbs that are potential translations of the English verb "to hit" are a good deal more explicit as to the kind of hitting that goes on, or, more generally, as to the specific characteristics of the situation they convey.

Again, I should like to stress that, from the language analyst's point of view, it is irrelevant whether this 'situation' be considered an observed or observable situation in the 'real' world or an imaginary or even illusory one in the speaker's mind. One thing, however, is certain: if we want to translate the English verb correctly into German, we have to find out more about the situations to which it may be applied. Fortunately it seems that we are well able to do this. It can be done in terms which are identical with those in which we describe observational situations, but this does not entail, nor even imply, that the situations must <u>be</u> observational. This should not be at all surprising: after all, we are quite accustomed to describing our dreams and our phantasies without having to resort to other terms or other linguistic forms than those we use in our descriptions of what is called observable reality. (3)

The very moment, however, we attempt to make the description (of the kind of situation that is conveyed by a verb) a little more precise than is usual among proficient language-users (who can always be relied on to draw on their experiential knowledge of situations to fill in what remains unsaid), we get into difficulty. Not an insurmountable difficulty, maybe, since we can always increase precision by adding more and more explanatory paraphrases; but, rather, a practical difficulty in the sense that accurate descriptions of verb-situations tend to become unmanageably long and cumbersome. This is above all due to the inherent/structural complexity of the kind of situation designated by verbs; and the complexity, I would suggest, stems from the fact

that we are here dealing with situations whose structure necessarily includes an element of time. (4)

That this should be so with verbs designating activity, process, or change of any kind, seems obvious; and on closer inspection it becomes clear that it is so also with the verbs that designate a state - for without there being at least an infinitesimal lapse of time in which no relevant change occurs, we cannot speak of state.

(Note that the very concepts of change and of state are correctly applied to a situation if and only if we have two items with different successive, coordinates in time, two items which we then consider to be identical and, in the case of 'state', equal in the respect we are concerned with, while, in the case of 'change', we find a difference. (5))

Thus, the situation structures underlying verbs must comprise at least two successive moments in time and something that is considered either to have changed in some respect, or to have remained the same in some respect, during the lapse of time encompassed by two (or more) moments*. Once we have become fully aware of this temporal sucession as a basic aspect of all verb situations, we discover that what differentiates these situations is, on the one hand, the characteristics we ascribe to each of the moments and, on the other, the kinds of relation we posit between them; besides, the division into moments also provides us with a means of mapping these situations with sufficient accuracy to display all the semantic differences we need in order to handle verbs satisfactorily.

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* The temporal dimension to which these 'moments' belong is obviously not the same as that referred to by the tenses of verbs; the second is the chronological time in which events take place, the first is the operational time implicit whenever we speak of a sequence of operations. Needless to say, in the present context, we are concerned exclusively with the operational time dimension in which the operations occur that yield the designata (concepts) of the words we are examining.

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If, for example, we consider verbs such as "to come", "to go", "to move", etc. (i.e. verbs that designate a situation which involves a change of place), we find that all of them involve a basic situation that can be described as follows:

at a moment M1 an item X is located at a location 1;

at a moment M2 an item which we consider to be the same as X, is located at a location 2.

Representing the succession of 'moments' of operational time from left to right on a horizontal axis, we at once have a kind of graphic shorthand notation that displays the situational structure:

M1	M2
X	X
loc.1	loc.2

Interpreting the relation involved in this situation is, perhaps, not as simple as it appears at first sight. In fact, two of the verbs mentioned above are ambiguous with regard to the relation they express; two examples will make this clear: "Sam goes to the bathroom" and "this pipe goes to the bathroom". In the first the different locations assigned to X are interpreted as 'motion', in the second as 'extension'. (6)

Leaving aside this ambiguity, let us try to explicate the differences that distinguish the situations designated by the three verbs. In situations that prompt us to use "to come", we have, in addition to the basic structure displayed above, an element that specifies the 'motion' (or extension) as reaching a particular point, namely a point with which the speaker in some way identifies himself; and this we can represent by the formula:

M1	M2	M3
X	X	X
loc.1	loc.2	loc.Sp.

The situation designated by "to go" is, of course, the inverse of this, and we can write its formula:

M1	M2	M3
X	X	X
loc.Sp.	loc.2	loc.3

(With "to go" there is another possible ambiguity which I am here disregarding: if X is of a certain kind - e.g. a machine - we may have neither locomotion nor extension, but 'stationary motion' or 'functioning'.)

The situation designated by "to move" differs in at least two respects from those represented above; first, it cannot be interpreted as 'extension' and, second, the verb does in no way indicate whether the item X, which changes its location, will - grammatically speaking - find expression as subject or as object of the verb.

The basic formula can easily be modified so as to exclude the 'extensional' interpretation:

M1	M2	M3
X	$\overline{X}$	X
loc.1	loc.1	loc.2

(i.e. at M1 the item X is in location 1; at M2 we have loc.1 without X; and at M3 the item X is in location 2.)

As to the second point of difference, the question of transitivity or intransitivity on the grammatical level, we have to expand our notation, because we now have to be able to represent a difference between the item that is operative in the 'change' (or 'state') expressed by the verb, and the item which is considered causally responsible for this change or state. We therefore write the formula for the intransitive "to move" (as in "the cloud moved slowly"):

M1	M2	M3
X	$\overline{X}$	X
loc.1	loc.1	loc.2

or, more economically:

M1		M2
X	....m....	X
loc.1		loc.2

where _ and the dotted line indicate 'motion', thus implying the absence of X in location 1 at any moment between M1 and M2. - The shortened formula for the transitive "to move" (as in "Sam moved the car") should be written:

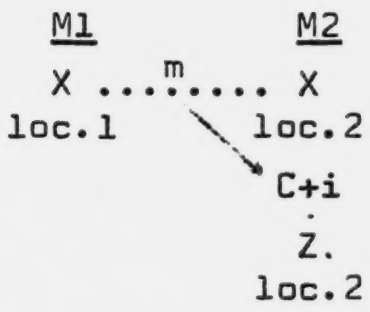
M1		M2
dX	↘	
Y	.....m.....	Y
loc.1		loc.2

where Y is the item that actually changes place (the car), X the item that causes the motion (Sam), and d an indication that the causation is deliberate and springs from a conative subject. The presence of causation is, in any case, indicated by an oblique arrow connecting the cause and its effect.

In order to describe more accurately the situations involved in the meaning of verbs, we have to introduce into the formulas a number of further specifications; they will be explained one by one, as they are needed in the analyses of the German verbs that correspond to the various uses of the English verb "to hit".

The basic situation expressed by the verb "to hit" consists of two items, one of which moves, and this motion causes the one item to come into contact with the other, with a certain force (impact). This basic situation, which

underlies the meaning of a considerable number of verbs in both English and German, can be represented as follows:



where X is the item that moves, Z the item with which contact is established, C+i the contact plus impact that is caused by the motion m.

(Note that by eliminating 'inpact' from this formula, writing C instead of C+i, we get the formula for the English verb "to touch".)

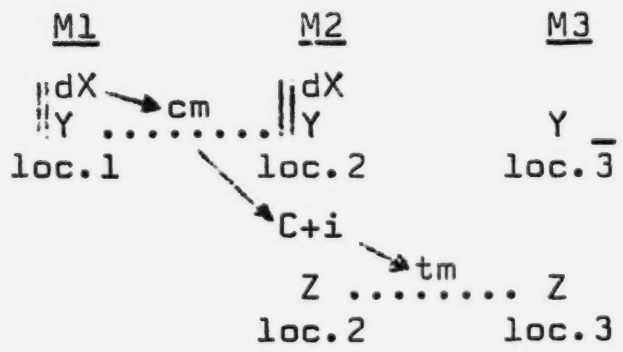
If we apply this to analyses of the verb "to hit" in context, choosing contexts that involve situations which are expressable by a German verb, we get formulas that are a good deal more specific.

1) "John hit the ball (200 yards)"

John schlug den Ball

German verb : SCHLAGEN

Italian verb : tirare



dX: deliberate conative subject;
||: prehensile hold, or part of;
Y: instrument or part of X;
cm: circular motion;
loc.$\overline{3}$: any location except loc.3;
Z: movable item;
tm: trajectory-type motion.

The German verb schlagen, complemented by a direct object, implies that the activity has an effect. In this example the effect is the motion of the ball (Z). If the context indicated that the ball did in fact not move, the verb schlagen would have to be combined with the preposition auf. The semantic situation in Italian is similiar but not identical: if, as in this example, one can infer that the motion of Z is of the 'trajectory-type', the verb has to be tirare; if no such inference is possible, the verb has to be colpire.

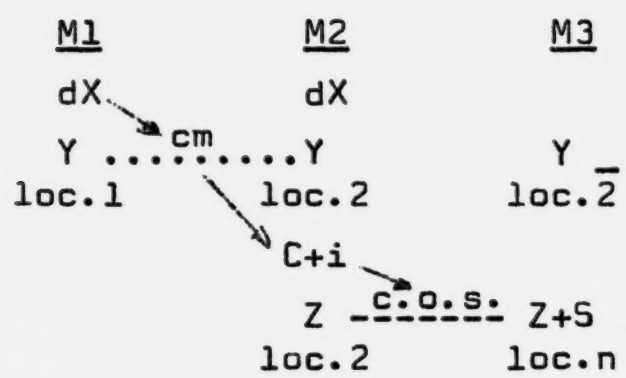
Note: within the range of the analyses exemplified here, three types of 'motion' are discriminated: motion defined simply as 'change of place'; 'circular motion', which is that of an item, held (prehensile contact) or otherwise attached, relative to the holding item and on a more or less circular path, but not necessarily full rotation; and, third, 'trajectory-type motion', which is regular motion along a predictable path, such as that of a bullet or a celestial body, determined either by natural laws or conative intention.

2) "John hit the dog (with his hand)"

John schlug den Hund

German verb: SCHLAGEN

Italian verb: colpire



$\overline{2}$: any loc. except loc.2,
c.o.s.: change of state;
Z+S: item manifesting sensation;
loc.n: any location whatever.

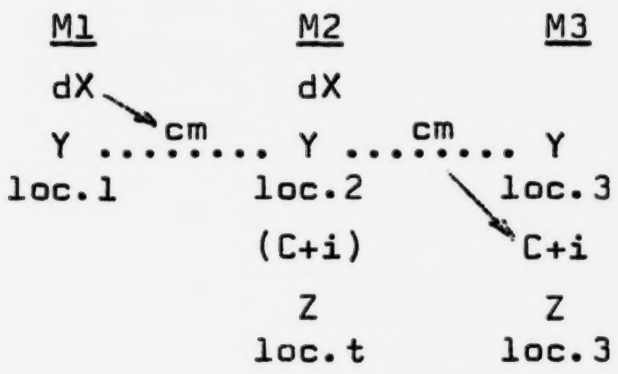
If the direct object of the German verb schalgen is a sentient item, the 'effect' of the indicated activity is an observable sensation of Z, mostly specifiable as pain. A third, rather restricted class of direct objects is admissible with that verb: items which change their structure as a result of the activity; with such an object, however, the German verb takes on a repetitive character and, consequently, corresponds to the English "to beat" (as in "she beat the cream").

3) "John hit the ball (after having missed it)"

John traf den Ball

German verb: TREFFEN

Italian verb: colpire



(C+i): representation of C with Z (i.e. aiming at Z);
Z: spatial item;
loc.t: target location.

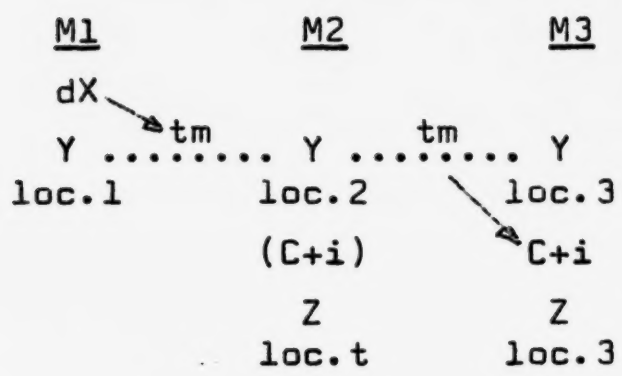
If the subject of the German verb treffen is conative, this implies an act of 'aiming', which we indicate by inserting a 'representation' (in this case the 'image' of a subsequent moment) into the formula; since the target, at the moment of aiming, need not be in the location where the actual contact will be established, we put 'target location', which could be any location except loc.1 or loc.2

4) "John hit the dog (with a stone he threw)"

John traf den Hund

German verb: TREFFEN

Italian verb: colpire



tm: trajectory-type motion;
(C+i): representation of C with Z;
loc.t: target location.

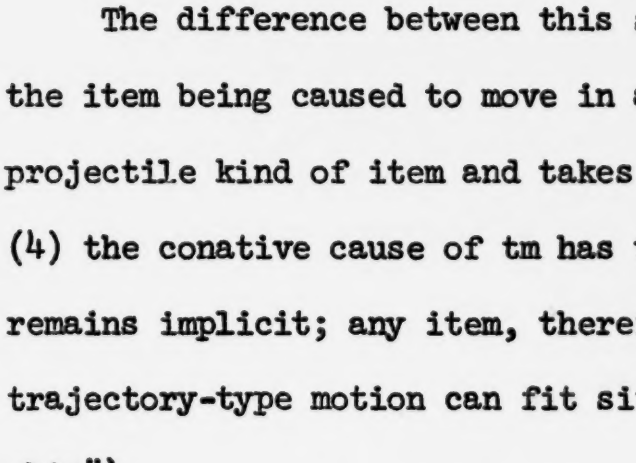
We represent 'trajectory-type motion' as a continued motion (loc.1 ... loc.2 ... loc.3); tm can be inferred from the conative subject plus a contextual indication of an activity such as "throwing", "shooting", or the like - or from a non-conative subject that directly implies that type of motion (cf. example

5) "The bullet hit the target"

Die Kugel traf das Ziel

German verb: TREFFEN

Italian verb: colpire



N: implicit cause of tm;

Y: non-conative subject implying trajectory-type motion.

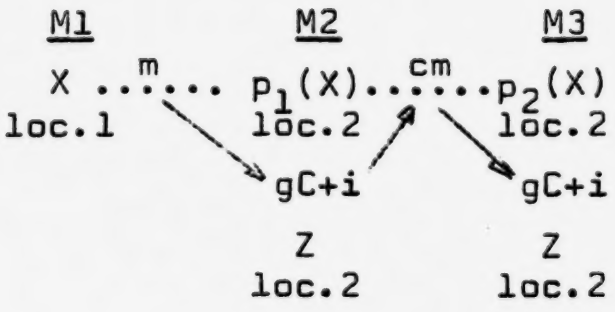
The difference between this situation and the preceding one is that here the item being caused to move in a trajectory-type motion is a non-conative projectile kind of item and takes the place of the subject, while in example (4) the conative cause of tm has the place of the subject and the projectile remains implicit; any item, therefore, which as such implies a determinate trajectory-type motion can fit situation 5 (e.g. "a meteorite hit the space ship").

6) "John hit the concrete (having fallen from the roof)"

John schlug auf den Zementboden

German verb: SCHLAGEN + AUF

Italian verb: sbattere contro



p_1,p_2: parts of X

cm: circular motion;

gC: contact in the direction of gravitational pull;

Z: immobile item.

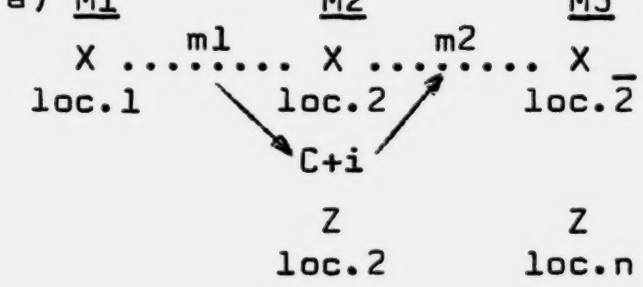
8) "John hit a tree (driving his car out of the garage)"

John stiess an (or gegen) einen Baum

German verb: STOSSEN + AN (or STOSSEN + GEGEN)

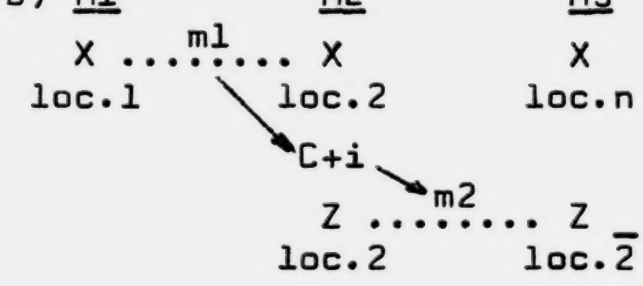
Italian verb: urtare contro

a)



m1: motion;
m2: altered motion (caused by i);
loc.2̄: any loc. except loc.2;
loc.n: any location whatever.

b)



m1: motion of X;
loc.n: any location whatever;
m2: motion of Z;
loc.2̄: any loc. except loc.2.

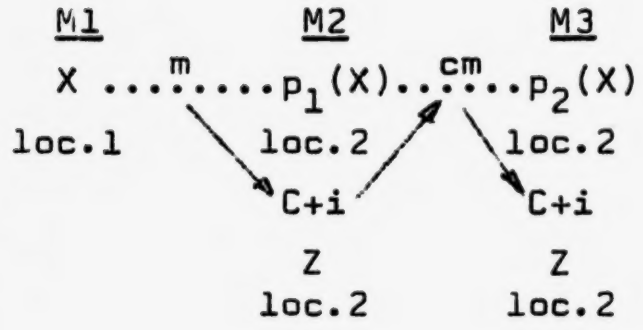
Combined with the preposition an, the verb stossen requires a sequel which may be either a further motion of X (formula 8a), but different from the motion that brought X into contact with Z (deflected, reversed, etc.), or motion of Z considered to be caused by the impact of X on Z (formula 8b). Regarding the use of the prepositions an and gegen there is a regional difference: in Northern Germany gegen is more usual with this verb and the combination covers both situation a and situation b; in Southern Germany and Austria an is more frequently used (ambiguously as to situations a and b) and gegen, if used at all, would imply situation a.

9) "The car hit a tree (after flying off the road)"

Der Wagen schlug an einen Baum

German verb: SCHLAGEN + AN
(or SCHLAGEN + GEGEN)

Italian verb: sbattere contro



p_1,p_2: parts of X;
m: motion of X,
cm: circular motion of X (caused by impact).

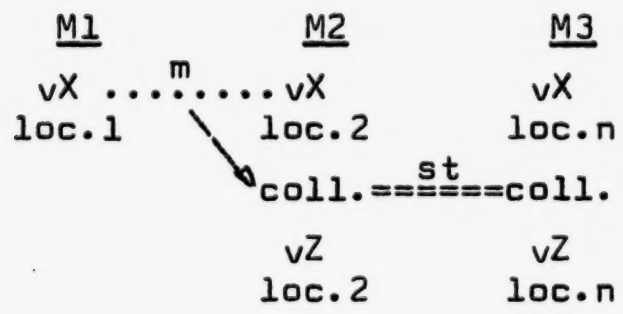
This formula is structurally identical with the one given for schlagen + auf in example 6; the only difference is that here, where the preposition is not auf, the direction of contact is not vertical.

10) "John met Mary (at the theatre)"

John traf Mary

German verb: TREFFEN

Italian verb: incontrare



vX: conative item (volitional)
coll.: collocation,
st: state (in this case: state in collocation).
vZ: conative item.

Although this situation is not covered by the English verb "to hit" it must be included in an analysis of the German verb treffen. It also serves to introduce the term 'collocation' which we use to indicate a frequently relevant semantic particle. A tentative definition of this term could be: spatial arrangement of two items, such that they can interact in one of several ways, e.g. exchange of spoken language. (In example 11 'collation'

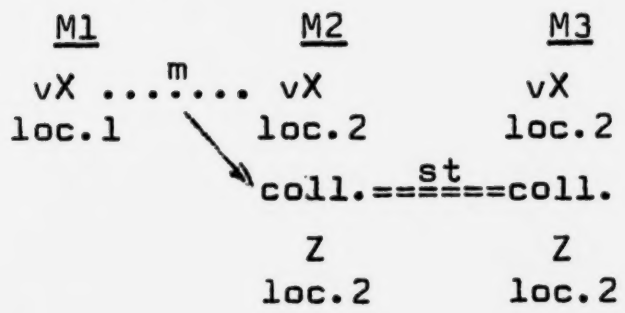
is used for a spatial situation that makes possible the subject's visual perception of the object.) - The decisive criterion for the use of treffen, in the above case, is that not only X but also Z is a conative item, and that 'collocation' is maintained regardless of the location of both X and Z in moment 3.

11) "The explorer came upon natives"

Der Forscher stiess auf Eingeborene

German verb: STOSSEN + AUF

Italian verb: incontrare



vX: conative item;
coll.: collocation.
st: state (in collocation).

The difference between this and the situation in example 10 is that here the object need not be a conative item; it can be any item coming within the range of visual perception and causing X's motion to be interrupted.

Conclusion

I should like to stress that these analyses of various uses of the German verbs which, under certain circumstances, correspond to the English verb "to hit", must be considered a preliminary sketch. They are incomplete, on the one hand, because not all possible situations covered by "to hit" are included, on the other, because the selected German verbs have been examined in some uses only, and by no means in all their possible uses.

No less preliminary are the definitions of the semantic particles displayed in the formulas. Experience has shown that one rarely succeeds in isolating and defining a semantic particle the first time it crops up in an analysis; it is only when the same particle is found to be relevant in the analysis of other verbs that it gains contour and becomes more satisfactorily defined.

Nevertheless, crude as they may be, these analyses do demonstrate one thing: the meanings of verbs can be mapped with considerable precision if they are viewed as situations in time, consisting of individual items and specific relations. This approach is, in principle, the same that we use when we analyse sentences and speak of lexical items and syntactic functions. The 'formulas', in fact, represent <u>meaning</u> in much the same way in which labelled tree diagrams represent the grammatical structure of sentences.

F O O T N O T E S

1) cf. E.v. Glasersfeld and P. P. Pisani, The Multistore Parser for Hierarchical Syntactic Structures, Communications of the Assoc. for Computing Machinery, Vol. 13, No. 2, February 1970.

2) Henry C. Wyld, Universal English Dictionary, London, 1936.

3) Professor Irena Bellert (University of Warsaw, Poland) has very elegantly formulated, from a logician's point of view, this independence of linguistic content and 'reality'; cf. her On the Use of Linguistic Quantifying Operators in the logico-Semantic Structure Representation of Utterances, International Conference on Computational Linguistics, Sanga Saby, Sweden, 1969.

4) Note that the German term for verb is Zeiwort, which, translated litterally, is "time word".

5) In his analysis of the term 'relation', Jeremy Bentham (The Theory of Fictions, edited by C. K. Ogden, London, 1932) supplies an operational definition that demonstrates the indispensability of the time element in the concept of relation. Independently, without any knowledge of Bentham's work, the investigations of Silvio Ceccato (Center for Cybernetics, University of Milan, Italy) in the 1950's, led to the very same operational definition of the basic relational process in human thinking.

6) It would, indeed, be comfortable if, on the strength of this example (and others like it) we could now divide all eligible subjects of the verb "to go" into those that require the verb's interpretation as 'motion', and those that require the verb's interpretation as 'extension'; if this were possible, the subject's classification would automatically determine which of the two interpretations is the correct one in a given case. A solution of this kind is what many advocators of 'componential semantic analysis' would suggest (e.g. Rubenstein, Miller, Katz & Fodor, etc.). Unfortunately there are relatively few items that give us certainty of interpretation and very many that give us, at best, a good probability - but even the best probability can, at times, be made unreliable by an unusual context. (For a more extensive discussion of this aspect cf. E. v. Glasersfeld, Operational Semantics, EURATOM Publication 296.e, Brussels, Belgium, 1963.)